

Comparing the effects of a cardiac rehabilitation program on functional capacity of obese and non-obese women with coronary artery disease

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Abstract

BACKGROUND: Obesity and sedentary lifestyle are known as important risk factors of coronary artery disease. The prevalence of obesity has increased among both men and women in the world. Therefore, the present study tried to evaluate the effectiveness of a cardiac rehabilitation program on functional capacity and body mass index (BMI) in obese and non-obese women with coronary artery disease.

METHODS: In an observational study during 2000-11, we evaluated a total of 205 women with coronary artery disease who referred to the cardiac rehabilitation unit of Isfahan Cardiovascular Research Institute, Isfahan, Iran. BMI and functional capacity of each patient were assessed before and after the program. The patients were categorized as obese or non-obese based on their BMI. All participants completed the full course of the program. Data was analyzed by independent t-test and paired t-test in SPSS₁₅.

RESULTS: Our finding showed that an 8-week cardiac rehabilitation program had significant effects on functional capacity in obese and non-obese female patients ($P < 0.01$ for both). The program also resulted in BMI improvements in both groups ($P < 0.01$ for both). Comparing the changes in the two groups did not reveal any significant differences in functional capacity. However, the two groups were significantly different in terms of BMI changes.

CONCLUSION: Cardiac rehabilitation programs are a major step in restoration of functional capacity and improvement of BMI in obese and non-obese women with coronary artery disease.

Keywords: Cardiac Rehabilitation Program, Coronary Artery Disease, Obesity, Functional Capacity, Body Mass Index.

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Introduction

Obesity and sedentary lifestyle are parallel important risk factors that increase the risk of coronary artery disease (CAD) in women.¹ The prevalence of obesity has risen among both men and women throughout the world.^{2,3} Obesity is identified based on body mass index (BMI). It is defined as a BMI ≥ 30 kg/m² and thus means an excess body weight for a particular height.^{2,4,5}

On the other hand, functional capacity (FC) is a strong predictor of mortality and morbidity in patients with CAD.⁶ Such patients usually suffer from cardiopulmonary and musculoskeletal limitations that greatly lessen their ability to exercise and daily physical tasks.^{6,7} Most studies have implied significant reductions in risks among active CAD patients compared to sedentary patients.⁸⁻¹⁰

According to previous research, cardiac

rehabilitation programs (CRPs), as an established treatment including the combined and coordinated use of medical, physical, psychosocial, and educational measures to return CAD patients to an active and satisfying lifestyle, are an essential way for improving FC and fitness level of cardiac patients.¹¹⁻¹³

Despite the numerous reports about the beneficial effects of CRP and exercise training on FC, limited data is available about the usefulness of CRP in obese cardiac patients, particularly women. Therefore, the purpose of this investigation was to evaluate the effectiveness of CRP on FC and weight reduction in obese female patients with CAD compared to non-obese female patients.

Materials and Methods

In an observational study during 2000-11, we

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evaluated a total of 205 female patients with CAD who referred to the phase II of cardiac rehabilitation unit at Isfahan Cardiovascular Research Institute (Isfahan, Iran). CAD was defined as a history of myocardial infarction (MI), coronary artery bypass grafting (CABG), percutaneous coronary intervention (PCI), or chronic stable angina. Before entering the CRP, written informed consents were obtained from all patients. Height (without shoes) and weight of each patient were then measured by a nurse after an overnight fast and after voiding. BMI was calculated by dividing weight to height squared (kg/m^2). According to BMI, patients were allocated into obese ($\text{BMI} \geq 30 \text{ kg}/\text{m}^2$) and non-obese ($\text{BMI} < 30 \text{ kg}/\text{m}^2$) groups. Moreover, the Naughton protocol was used to perform exercise test on each patient under supervision of a cardiologist. Exercise test provided an opportunity to determine body reaction and FC by indicating hemodynamic responses and metabolic equivalent (MET). Afterwards, both groups participated in a CRP for 2 months. The program consisted of 24 sessions, i.e. 3 times a week for 8 weeks. It included exercise training sessions, nutritional and psychological consultation, and risk factor management. Exercise sessions were similar for obese and non-obese patients and consisted of combined aerobic and resistance training. The sessions were held in the cardiac rehabilitation center under the supervision of a physician, an exercise physiologist, and a nurse. Patients were supposed to use treadmills, stationary cycles, stationary steppers, and some resistance devices. Stair climbing, rowing, and jogging were also included. Each session lasted up to 90 minutes and comprised a 10-minute warm-up followed by 60 minutes of aerobic and resistance training, a 10-minute cool-down, and 10 minutes of relaxation. The intensity of training was established according to patients' clinical conditions and calculated as 60-85% of maximum heart rate. Dietitians provided all participants with dietary instructions. The patients were encouraged to complete the course of CRP by the physicians, exercise physiologists, and dietitians. Angina treatments were continued at the prescribed dose while no weight reduction medication was used. After

2 months and completing the CRP, all tests were carried out for each patient again. The research was conducted under the medical ethics standards and approved in the Ethics Committee of Isfahan Cardiovascular Research Institute. Independent sample t-test was used to identify baseline differences. On the other hand, paired t-test was employed to investigate the changes caused by the CRP. The results were expressed as mean $\pm$ standard deviation (SD) and the level of significance was set at $P < 0.05$. All analyses were performed in SPSS₁₅ (SPSS Inc., Chicago, IL, USA).

Results

Overall, 205 women with CAD were evaluated. They were divided into two groups of obese ($\text{BMI} \geq 30$; $n = 84$; mean age: 57.6 ± 7.94 years) and non-obese ($\text{BMI} < 30$; $n = 121$; mean age: 58.09 ± 8.95 years). Independent sample t-test showed that at baseline, obese patients had lower FC than non-obese patients ($P = 0.001$) (Table 1).

In addition, paired t-tests revealed that the CRP significantly improved FC and BMI in both groups ($P = 0.03$). Independent sample t-test was also used to compare the 2 groups after the CRP. Although no significant difference was observed in FC between the two groups, the two groups were significantly different in terms of BMI changes.

Discussion

In this study, we demonstrated that 8 weeks of CRP and regular exercise training had beneficial effects on FC and BMI in obese and non-obese women with CAD. Moreover, comparing the changes in the two groups showed that following the CRP, obese patients had a relative improvement in BMI compared to non-obese patients. FC, which is a main indicator in CAD, was notably affected by obesity. In fact, at baseline, obese patients had lower FC than non-obese patients. However, after the period of the CRP and performing regular physical activity, they enjoyed a higher, but statistically insignificant, level of fitness. It can thus be concluded that lower levels of FC at baseline may predict improvement in obese

Table 1. Changes in functional capacity and weight within and between groups following the cardiac rehabilitation program (CRP)

	Obese women			Non-obese women		
	Before CRP	After CRP	P	Before CRP	After CRP	P
Functional capacity (Mets)	5.94 ± 1.68	7.87 ± 2.08	< 0.01	6.96 ± 2.44	8.70 ± 2.53	< 0.01
Body mass index (kg/m^2)	33.50 ± 2.75	32.69 ± 3.00	< 0.01	26.28 ± 2.66	25.76 ± 2.58	< 0.01

Values were measured using paired sample t-tests and are expressed as mean $\pm$ SD

patients. In addition, greater improvements in BMI could also explain the greater development in FC in our obese female patients.

Most previous studies were consistent with our results.^{10,11,14,15} Ades found exercise capacity to constantly improve after cardiac rehabilitation. Therefore, exercise tolerance on the treadmill and peak oxygen consumption increased and everyday activities, such as climbing stairs and carrying groceries, improved in cardiac patients. Ades also reported that weight reduction was the goal of CRP in these patients and that a combination of dietary interventions and exercise training resulted in reduced BMI.¹⁶ Likewise, Kennedy et al. suggested CRP to play an important role in improving functional independence in all age groups of women. They also indicated increased exercise capacity to be associated with improvements in the ability to perform everyday activities and to feel less fatigue while doing routine tasks.¹⁷ A previous article proposed that high calorie expenditure exercise for overweight coronary patients resulted in greater weight loss compared to standard cardiac rehabilitation.⁸ Similarly, Bocalini et al. recommended supervised physical exercise as a safe method with the potential to improve FC in patients with heart failure.¹¹ 12 weeks of resistance training improved muscle strength and exercise capacity in patients with stable chronic heart failure.⁹ Lavie and Milani demonstrated that despite improvements in BMI among obese patients with CAD, statistically significant changes in BMI were not observed in non-obese patients.¹⁸ Another study used 6-minute walking test and reported CRP to be useful in improving FC and enhancing muscle strength in patients after CABG.¹⁹

On the other hand, in contrast to our results, a study showed obese patients to have lower work capacity at both baseline and follow-up. These patients also gained smaller work capacity from baseline to follow-up than non-obese and overweight patients. In fact, their results implied that obese patients benefited less from the CRP than did normal-weight patients.²⁰ Another study detected that CRP had short-term efficiency on FC and BMI in obese patients with coronary heart disease.²¹ Kiat et al. revealed that a CRP did not affect weight loss but enhanced FC level in patients with CAD.²²

Generally, it should be noticed that cardiac adaptations result in increased cardiac dimensions, stroke volume, and cardiac output which in turn increase the blood flow to skeletal muscles and allow the tissues to receive adequate oxygen. Finally, a growing difference in oxygen content between arterial and venous blood occurs during exercise. This

process would ultimately lead to increased aerobic capacity in the exercised muscle. On the other hand, vascular adaptations increase the density of skeletal muscle capillaries and improve endothelial-dependent vasodilatation in both epicardial and coronary arteries and thus help these progressions.^{7,23} These physiological adaptations increase exercise tolerance and fitness level and reduce cardiorespiratory symptoms in women with CAD.

Conclusion

According to the findings of this study and similar research, we can notify a CRP, carried out by cardiac patients under the supervision of a physician and an exercise physiologist, to play a major role in management of obesity and FC in both obese and non-obese female patients.

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Conflict of Interests

Authors have no conflict of interests.

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